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Sir:

Transmitted herewith for filing under 37 C.F.R. §1.53(b) is the patent application of:
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For: RECORDING MEDIUM, AND SYSTEM AND METHOD FOR RECORDING AND
PRODUCING THE RECORDING MEDIUM

- ☒ Specification (22 pages)
☒ 7 sheets of drawings
☒ Declaration and Power of Attorney
☒ Return Receipt Postcard
☒ An Assignment of the invention to Pioneer Corporation with PTO-1595
☒ A certified copy of Japanese application(s) No.(s) 11-016838; dated January 26, 1999
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	(Col. 1)	(Col. 2)
FOR:	No. Filed	No. Extra
BASIC FEE		
TOTAL CLAIMS	17 - 20 =	* 0
INDEP CLAIMS	4 - 3 =	* 1
___ MULTIPLE DEPENDENT CLAIM PRESENTED		

Small Entity	
RATE	FEE
	\$345
x 9 =	
x 39 =	
+130 =	
TOTAL	

Other Than A Small Entity	
RATE	FEE
	\$690
x 18 =	0
x 78 =	78
+260 =	0
TOTAL	\$768


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TITLE OF THE INVENTION

RECORDING MEDIUM, AND SYSTEM AND METHOD FOR RECORDING
AND REPRODUCING THE RECORDING MEDIUM

5 BACKGROUND OF THE INVENTION

The present invention relates to a recording medium,
and a system and a method for recording and reproducing the
recording medium, and more particularly to a recording medium
having a logical data structure for editing recorded
10 information.

There has been known the DVD-Video, which is an optical
read-only disc capable of storing high-quality video
information and audio information. The DVD-Video records
information based on a specific logical data structure so
15 as to be applied in an extensive field and to have various
functions enabling various interactive reproduction
thereof.

In accordance with the logical data structure, which
is disclosed in known documents, the DVD-Video comprises a
20 lead-in area at the inner end portion of the disc, lead-
out area at the outer end portion, and a data recording area
between the lead-in and lead-out areas wherein a plurality
of data files are stored.

The data which is recorded in the data recording area
25 can be roughly divided into presentation data to be
reproduced and navigation data for controlling the
reproduction. The navigation data includes attribute of the
presentation data and control data necessary for the

reproduction. There are five navigation data, which are video manager information (VMGI), video title set information (VTSI), program chain information (PGCI), presentation control information (PCI), and data search
5 information (DSI).

The presentation data comprises video data, audio data and subpicture data which are integrated together with a part of the navigation data in accordance with the MPEG 2 standard (ISO 13818-1).

10 The video data has one stream of data compressed in accordance with the MPEG 2 video format (ISO 13818-2). The audio data take up a maximum of eight streams and comply with in one of the linear PCM, AC-3 and MPEG audio standards.

The subpicture data are data compressed in accordance
15 with the run-length coding for enabling menus, and credits and words in the case of movies and karaoke system to be displayed over the main image, and take up a maximum of 32 streams.

These video data, audio data, and subpicture data are
20 aggregated into sets in pack unit so as to form a bit stream multiplexed in plurality of pack units, thereby forming the presentation data.

The presentation control information (PCI) and data search information (DSI) are added to each of the video data,
25 audio data and subpicture data to form a video object unit (VOBU).

The presentation control information (PCI) is provided for determining the reproduction information in

accordance with the condition of the presentation data. The data search information (DSI) relates to fast forward and rearward reproductions and continual reproduction.

5 A plurality of video object units (VOBU) form a cell (CELL), and a plurality of cells (CELL) form a video object (VOB), and a plurality of video objects (VOB) form a video object set (VOBS).

10 The video title set information (VTSI) and the program chain information (PGCI) are added to one or more video object set (VOBS) to form a video title set (VTS). A plurality of video title sets (VTS) are recorded sequentially after control data called video manager (VMG) having video manager information (VMGI).

15 The video title set information has attribute information of the video object set (VOBS) in the video title set (VTS). The program chain information (PGCI) has information on reproducing order of the presentation data in the form of information on order of the cells (CELL). The video manager information (VMGI) has information on the
20 directory of the video title set (VTS).

The reproduction of the presentation data is controlled in accordance with the information of the navigation data so as to enable the interactive reproduction.

25 The DVD-RW (rewritable) has also become to attract attention in addition to the DVD-Video. The DVD-RW belongs to the same so-called DVD family including the DVD-Video, and has the physical compatibility therewith. Since the DVD-RW is capable of recording, reproducing, erasing and

rewriting information, it is a recording medium extremely suitable to the user for producing or authoring a desirable multimedia title.

5 A method called after recording is frequently used to produce such a multimedia title. In accordance with the after recording, the video data is recorded beforehand, and audio data such as voice, music, and sound effects are later recorded, new audio data are added to the previously recorded audio data or the recorded audio data are rewritten. Hence
10 the operations for editing the titles are facilitated.

However, the user must carry out the after recording operation while confirming that the audio data can be after-recorded over the recorded data.

15 Since the DVD-RW records the title in accordance with the logical data structure which is the same as that of the DVD-Video, it is necessary to reproduce the recorded title to confirm whether the audio data can be after-recorded or not. Namely, the user must undergo a troublesome and time-consuming operation of operating the DVD recording and
20 reproducing device, searching and reproducing the presentation data with a pickup thereof, and confirming the reproduced video information and audio information.

Thus there has been a demand for improving the operability at the after recording. Moreover, it is
25 preferable to improve the operability not only of the after recording but also at addition and rewriting of information.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a recording medium having a data structure suitable for improving the operability at addition and rewriting of recorded information.

5 According to the present invention, there is provided a recording medium comprising, a first recording area on which recording information is recorded, a second recording area on which management information for managing the recording information is recorded, wherein the second
10 recording area includes a bit rate recording area that records a bit rate.

The recording information includes at least a video data and an audio data, the bit rate is a bit rate of the audio data.

15 The present invention further provides an apparatus for recording recording information on a recording medium comprising, recording means for recording a bit rate on the recording medium together with the recording information when the recording information is recorded.

20 The recording information includes at least a video data and an audio data, the bit rate is a bit rate of the audio data, and the recording medium includes a first recording area on which recording information is recorded and a second recording area on which management information
25 for managing the recording information is recorded, the bit rate is recorded to the second recording area.

The present invention still further provides an apparatus for recording recording information on a recording

medium comprising, recording system that records a bit rate on the recording medium together with the recording information when the recording information is recorded.

5 The recording information includes at least a video data and an audio data, the bit rate is a bit rate of the audio data, and the recording medium includes a first recording area on which recording information is recorded and a second recording area on which management information for managing the recording information is recorded, the bit
10 rate is recorded to the second recording area.

The present invention further provides a method of recording recording information on a recording medium comprising, a recording step of recording a bit rate on the recording medium together with the recording information
15 when the recording information is recorded.

The recording information includes at least a video data and an audio data, the bit rate is a bit rate of the audio data, and the recording medium includes a first recording area on which recording information is recorded
20 and a second recording area on which management information for managing the recording information is recorded, the bit area is recorded to the second recording area.

These and other objects and features of the present invention will become more apparent from the following
25 detailed description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a block diagram showing a recording and reproducing system of the present invention;

Fig. 2 is an illustration showing a structure of a logical data of a recording medium of the present invention;

5 Fig. 3 shows video management information;

Fig. 4 shows a video pack;

Figs. 5a to 5c show audio packs; and

Figs. 6 and 7 show flowcharts of operation of the system of the present invention.

10

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Fig. 1, a recording and reproducing system 1 of the present invention comprises a spindle motor 3 for rotating a DVD-RW 2, pickup 4 for recording and reproducing information on and from the DVD-RW 2, servo circuit 5 for controlling the spindle motor 3 and pickup 4, recording system 6 for producing data to be recorded on the DVD-RW 2, reproducing system 7 for reproducing data recorded on the DVD-RW 2, central control circuit 8 for controlling the system 1, operating section 9 for instructing the central control system 8 to control the system by a user, and display 10.

The recording system 6 comprises an A/D converters 11 and 12, audio compressing circuit 13, video compressing circuit 14, multiplexer 15, recording buffer memory 16, encoder 17 and recording circuit 18.

The A/D converter 11 converts an input analog audio signal S_{AI} to a digital audio data D_{AI} .

The audio compressing circuit 13 compresses the audio data D_{AI} at a compression format designated by a control signal C1 applied from the central control circuit 8 to produce a compressed audio data DP_{AI} which is fed to the multiplexer 15. In accordance with the present embodiment, the data are compressed in accordance with one of the linear PCM standard, AC-3 standard, and the MPEG audio standard, which is selected by operating the operating section 9.

The A/D converter 12 converts an input analog video signal S_{VI} to a digital video data D_{VI} . The video compressing circuit 14 compresses the video data D_{VI} to produce a compressed video data DP_{VI} which is fed to the multiplexer 15. The data are compressed at the video compressing circuit 14 in accordance with the MPEG 2 video format (ISO 13818-2).

The multiplexer 15 multiplexes the compressed audio data DP_{AI} with the compressed video data DP_{VI} at a predetermined timing designated by a control signal C2 from the central control circuit 8 to produce a compressed data DP_w which is time-shared.

When the user instructs the after recording, the multiplexer 15 is applied with compressed audio data DP_{AI} , compressed video data DP_{VI} at the predetermined timing designated by the control signal C2 and a decoded data DP_{AV} which will be described later in detail, so that the data are multiplexed, thereby generating the time-shared compressed data DP_w .

The recording buffer memory 16 temporarily stores the compressed audio data DP_{AI} , the compressed video data DP_{VI} and

the decoded data DP_{AV} to produce the compressed data DP_w , cooperating with the mutiplexer 15. The compressed data DP_w is fed to the encoder 17. Further, the recording buffer memory 16 applies a data quantity signal Cmw representing the length of the data to the central control circuit 8. A data quantity dependent on the data quantity signal Cmw is displayed on the display 10.

The encoder 17 encodes the compressed data DP_w in accordance with a control signal $C3$ from the central control circuit 8 to produce an encoded data D_{WE} which is fed to the recording circuit 18.

The recording circuit 18 power-amplifies the encoded data D_{WE} in accordance with a control signal $C4$ from the central control circuit 8 to produce a recording data D_{WT} which is applied to the pickup 4.

A semiconductor laser provided in the pickup is driven by the recording data D_{WT} to emit a laser beam, so that the recording data D_{WT} is recorded on the DVD-RW 2.

The reproducing system 7 comprises a D/A converter 19 and 20, video extending circuit 21, audio extending circuit 22, demultiplexer 23, reproducing buffer memory 24, decoder 25 and reproducing circuit 26.

The reproducing circuit 26 shapes the waveform of a detected signal D_{RD} read out from the DVD-RW 2 by the pickup in accordance with a control signal $C5$ from the central control circuit 8 to produce a binary reproducing data D_{PP} which is fed to decoder 25.

The decoder 25 decodes the reproducing data D_{PP} based

on a predetermined decode system corresponding to the encode system of the encoder 17 in accordance with a control signal C6 from the central control circuit 8 to produce a decoded data DP_R which is applied to the reproducing buffer memory 24.

The buffer memory 24 temporarily stores the decoded data DP_R and sends a data quantity signal C_{mr} representing the length of the decoded data DP_R to the central control circuit 8. A data quantity of the decoded data DP_R is displayed on the display 10. Furthermore, the reproducing memory 24 arranges the temporarily storing decoded data DP_R into the decoded data DP_{AV} in synchronism with a predetermined timing. The decoded data DP_{AV} is fed to the demultiplexer 23.

As described above, when the user operates the operating portion 9 in order to instruct the central control circuit 8 to execute the after recording process, the decoded data DV_{AV} are supplied to the multiplexer 15.

The demultiplexer 23 demultiplexes a compressed video data DP_{V0} and a compressed audio data DP_{A0} which are multiplexed in the decoded data DP_{AV} in accordance with a control signal C7 from the central control circuit 8. The compressed video data DP_{V0} supplied to the video extending circuit 21, and the compressed audio data DP_{A0} is supplied to the audio extending circuit 22.

The video extending circuit 21 extends the compressed video data DP_{V0} to produce an extended video data D_{V0} . The D/A converter 19 converts the video data D_{V0} to produce an

analog video signal S_{vo} .

The audio extending circuit 22 extends the compressed audio data DP_{Ao} to produce an extended audio data D_{Ao} . The D/A converter 20 converts the audio data D_{Ao} to produce an analog audio signal S_{Ao} . The digital audio data D_{Ao} generated at the audio extending circuit 22 is externally outputted.

The central control circuit 8 has a memory 8a storing a system program and others and a CPU for controlling the operation of the whole system.

Namely, the central control circuit 8 controls the operation of the servo circuit 5, the recording system 6, and the reproducing system 7, and displays menus indicating a manipulation method and others on the display 10.

Fig. 2 shows the whole logical data structure. The DVD-RW 2 comprises a lead-in area LI at the inner end portion of the disc, data recording area DZ and lead-out area LO.

The data recording area DZ comprises a UDF recording area 27 wherein a micro-Universal Disc Format (UDF) as a logical format representing the relationship between the physical address and the logical address is recorded, and a video data recording area VDZ.

The video data recording area VDZ comprises a video manager recording area 28 wherein a control data having a video manager information (VMGI) is recorded, and a recording area 29 wherein video data, audio data, and others are recorded.

In the video data recording area VDZ, data are recorded as a plurality of files 30 which are divided into a plurality

of sets each of which comprises a plurality of files.
Further, the sets are hierarchized.

The data recorded in the data recording area DZ roughly
comprises the presentation data and navigation data. The
5 presentation data has video data, audio data, and subpicture
data packaged into packs and integrated with predetermined
navigation data in accordance with the MPEG 2 standard (ISO
13818-1).

As an uppermost order recording unit, there is provided
10 video title sets (VTS: Video Title Set) 31 from #1 to #n
wherein a video title can be recorded. Each video title set
is combined with a video object set (VOBS: Video Object Set)
32.

Each video object set 32 comprises one or more video
15 object (VOB) 33 and is identified by an ID number (V-ID1 ~
V-IDi).

Each video object 33 comprises one or more cell (CELL)
34, and each cell 34 comprises one or more video object unit
(VOBU) 35. Each cell 34 is identified by an ID number (C-ID1
20 ~ C-IDj).

Each video object unit (VOBU) 35 comprises one or more
video pack V, audio pack A and subpicture pack S.

Namely, the presentation data comprising the video
pack V, audio pack A and the subpicture pack S are assigned
25 to video object unit (VOBU) 35, cell (CELL) 34, video object
(VOB) 33, video object set (VOBS) 32 and video title set (VTS)
31 so as to be managed.

Referring to Fig. 3, in the video manager recording

area 28, video manager information (VMGI) including at least the program chain information (PGCI) and video object information (VOBI) is recorded.

5 The video object information is information relative to the attribute of each video object and the data length.

The program chain information (PGCI) is provided with information indicating reproducing order of the presentation data, which is assigned at the video title sets VTS(#1) ~ VTS(#n).

10 The video manager information (VMGI) is a management data for recording and reproducing the video title sets VTS(#1) ~ VTS(#n). In the program chain information (PGCI), the information regarding the reproducing order of the presentation data is recorded as the information regarding
15 the order of the cells (CELL). The video object information (VOBI) is a table for recording the attribute and the data length of the presentation data for each unit of video object (VOB).

20 One of the items in the video object information (VOBI) is an audio stream attribute table (VOB-AST-ATRT) for writing the attribute of the audio pack A included in the video object (VOB).

25 The audio stream attribute table (VOB-AST-ATRT) comprises three bytes and stores information on audio coding mode, audio application mode, quantization Qb, sampling frequency fs, number CHn of audio channel, and bit rate.

The audio coding mode indicates which of the MPEG audio, AC-3 and linear PCM compressing standards is used for the

audio pack A. In the audio application mode, a flag related to the audio attribute of the video object (VOB) is recorded.

Namely, the information recorded in the audio stream attribute table (VOB-AST-ATRT) represents the quality of the audio stream recorded on the DVD-RW 2. Upon reproduction, the information recorded in the audio stream attribute table (VOB-AST-ATRT) is reproduced and shown on the display 10 so as to indicate the user the quality of the recorded audio stream.

Referring to Fig. 4, a pack header, packet header and video data are recorded in the video pack V.

In the audio pack A, audio data are variously recorded in accordance with the difference of the compression system as shown in Figs. 5a, 5b and 5c.

The operation of the after recording the DVD-RW 2 using the recording and reproducing system 1 is described hereinafter with reference to Figs. 6 and 7. The operation is controlled by the microcomputer (CPU) provided in the central control circuit 8.

Referring to Fig. 6, when it is detected that the DVD-RW 2 is inserted at a step 100, at a step 101, the information thereof is read out by the pickup 4 to retrieve the control data necessary for reproduction. When it is determined at a step 102 that the user did not instruct the after recording, the program goes to a step 103 wherein it is further determined whether the ejection of the disc is instructed. When NO, the program returns to the step 102. On the other hand, when the ejection is instructed, the necessary

management data is recorded on the DVD-RW 2 at a step 104,
and the DVD-RW 2 is ejected at a step 105.

When the after recording is instructed at the step 102,
the data in the audio stream attribute table (VOB-AST-ATRT)
5 included in the control data retrieved at the step 101 is
checked at a step 106. Namely, the bit rate and the data
of the audio coding mode already recorded in the audio stream
attribute table (VOB-AST-ATRT) are compared with the bit rate
and the data of the audio coding mode of the audio data which
10 the user intends to record at the after recording.

At a step 107, it is determined whether the bit rate
of the audio data for the after recording is in compliance
with that of the audio data already recorded based on the
comparison. If the bit rates do not comply with each other,
15 it is determined at the step 107 that the after recording
is not possible and the program proceeds to a step 108. At
the step 108, an indication to the effect that the after
recording cannot be performed is shown on the display 10.
Thereafter, the program returns to the step 102 after a pause
20 at a step 111, thereby awaiting the next instruction by the
user.

When it is possible to after-record, the program
proceeds from the step 107 to a step 109 where a recording
area for an audio encoder is set in the recording buffer
25 memory 16. Thereafter, the after recording is carried out
at a step 110.

The process of the after recording is described in
detail in Fig. 7. At steps 200 and 201, the pickup 4 reads

out the data from the DVD-RW 2, and the read out data are applied to the reproducing circuit 26, decoder 25, and reproducing buffer memory 24, thereby decoded. The decoded data DP_{AV} are supplied to the multiplexer 15.

5 At a step 202, the multiplexer 15 multiplexes the compressed audio data DP_{AI} which is the audio data for after recording, with the decoded data DP_{AV} in accordance with the control signal C2 from the central control circuit 8. The data in the video pack and subpicture pack of the decoded
10 data DP_{AV} remain unchanged while the compressed audio data DP_{AI} is recorded in the audio data pack. The recording is carried out in the unit of the error correction code (ECC) provided for the error correction.

 Thus the data DP_{AO} on the audio information included
15 in the decoded data DP_{AV} is exchanged for the after recording audio data DP_{AI} . The multiplexed compressed data D_{PW} is thus generated from the recording buffer memory 16. At steps 203 and 204, the multiplexed compressed data D_{PW} is applied to the pickup 4 through the encoder 17 and the recording circuit
20 18 so as to write the data on the DVD-RW 2.

 The steps 200 to 204 are repeated until it is determined at a step 205 that all of the after recording audio data DP_{AI} is recorded on the DVD-RW 2. When the after recording is completed, the program goes to the step 111, and thereafter
25 to the step 102 in Fig. 6.

 Thus in the present embodiment, since the bit rate information is recorded in the audio stream attribute table (VOB-AST-ATRT) in the video object information (VOBI), by

retrieving the bit rate information, the data length of the already recorded audio data and that of the after recording audio data can be compared with each other. Thus it can be easily checked whether the after recording can be executed
5 or not.

Whereas with the conventional recording medium, it is necessary to confirm the stream of the recorded audio data at the after recording, thereby necessitating a troublesome operation, in accordance with the present invention, such
10 an operation is not needed so that the operability is improved.

The operability is improved also when adding or rewriting information.

While the invention has been described in conjunction
15 with preferred specific embodiment thereof, it will be understood that this description is intended to illustrate and not limit the scope of the invention, which is defined by the following claims.

What is claimed is

1. A recording medium comprising:
a first recording area on which recording information is recorded;
5 a second recording area on which management information for managing the recording information is recorded; wherein
said second recording area includes a bit rate recording area that records a bit rate.
- 10 2. The recording medium according to claim 1, wherein
said recording information includes at least a video data and an audio data;
said bit rate is a bit rate of the audio data.
- 15 3. An apparatus for recording recording information on a recording medium comprising:
recording means for recording a bit rate on the recording medium together with the recording information when the recording information is recorded.
- 20 4. The apparatus according to claim 3, wherein
said recording information includes at least a video data and an audio data;
said bit rate is a bit rate of the audio data.
- 25 5. The apparatus according to claim 3, wherein
said recording medium includes a first recording area on which recording information is recorded and a second recording area on which management information for managing the recording information is recorded;

said bit rate is recorded to the second recording area.

6. The apparatus according to claim 3, further comprising:

5 reproducing means for reproducing the recorded bit rate of the recording information together with the recording information when the recorded recording information is reproduced.

7. The apparatus according to claim 6, further comprising:

10 control means for determining whether the renewal recording or addition recording is possible based on the bit rate and a bit rate of the new recording information when new recording information is recorded for renewal of addition, and for starting the renewal recording or the addition
15 recording when the renewal recording or the addition recording is possible.

8. An apparatus for recording recording information on a recording medium comprising:

20 recording system that records a bit rate on the recording medium together with the recording information when the recording information is recorded.

9. The apparatus according to claim 8, wherein said recording information includes at least a video data and an audio data;

25 said bit rate is a bit rate of the audio data.

10. The apparatus according to claim 8, wherein said recording medium includes a first recording area on which recording information is recorded and a second

recording area on which management information for managing the recording information is recorded;

said bit rate is recorded to the second recording area.

11. The apparatus according to claim 8, further
5 comprising:

reproducing system that reproduces the recorded bit rate of the recording information together with the recording information when the recorded recording information is reproduced.

10 12. The apparatus according to claim 11, further comprising:

control system that determines whether the renewal recording or addition recording is possible based on the bit rate and a bit rate of the new recording information when
15 new recording information is recorded for renewal or addition, and that starts the renewal recording or the addition recording when the renewal recording or the addition recording is possible.

13. A method of recording recording information on
20 a recording medium comprising:

a recording step of recording a bit rate on the recording medium together with the recording information when the recording information is recorded.

14. The method according to claim 13, wherein
25 said recording information includes at least a video data and an audio data;

said bit rate is a bit rate of the audio data.

15. The method according to claim 13, wherein

said recording medium includes a first recording area on which recording information is recorded and a second recording area on which management information for managing the recording information is recorded;

5 said bit area is recorded to the second recording area.

16. The method according to claim 13 further comprising:

10 a reproducing step of reproducing the recorded bit rate of the recording information together with the recording information when the recorded recording information is reproduced.

17. The method according to claim 16 further comprising:

15 a step of determining whether the renewal recording or addition recording is possible based on the bit rate and a bit rate of the new recording information when new recording information is recorded for renewal or addition;

20 a step of starting the renewal recording or the addition recording when the renewal recording or the addition recording is possible.

RECORDING MEDIUM, AND SYSTEM AND METHOD FOR
RECORDING AND REPRODUCING THE RECORDING MEDIUM

Abstract of the Disclosure

5 A recording medium has a first recording area on which
recording information is recorded, and a second recording
area on which management information for managing the
recording information is recorded. The second recording
area includes a bit rate recording area for recording a bit
10 rate.

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2
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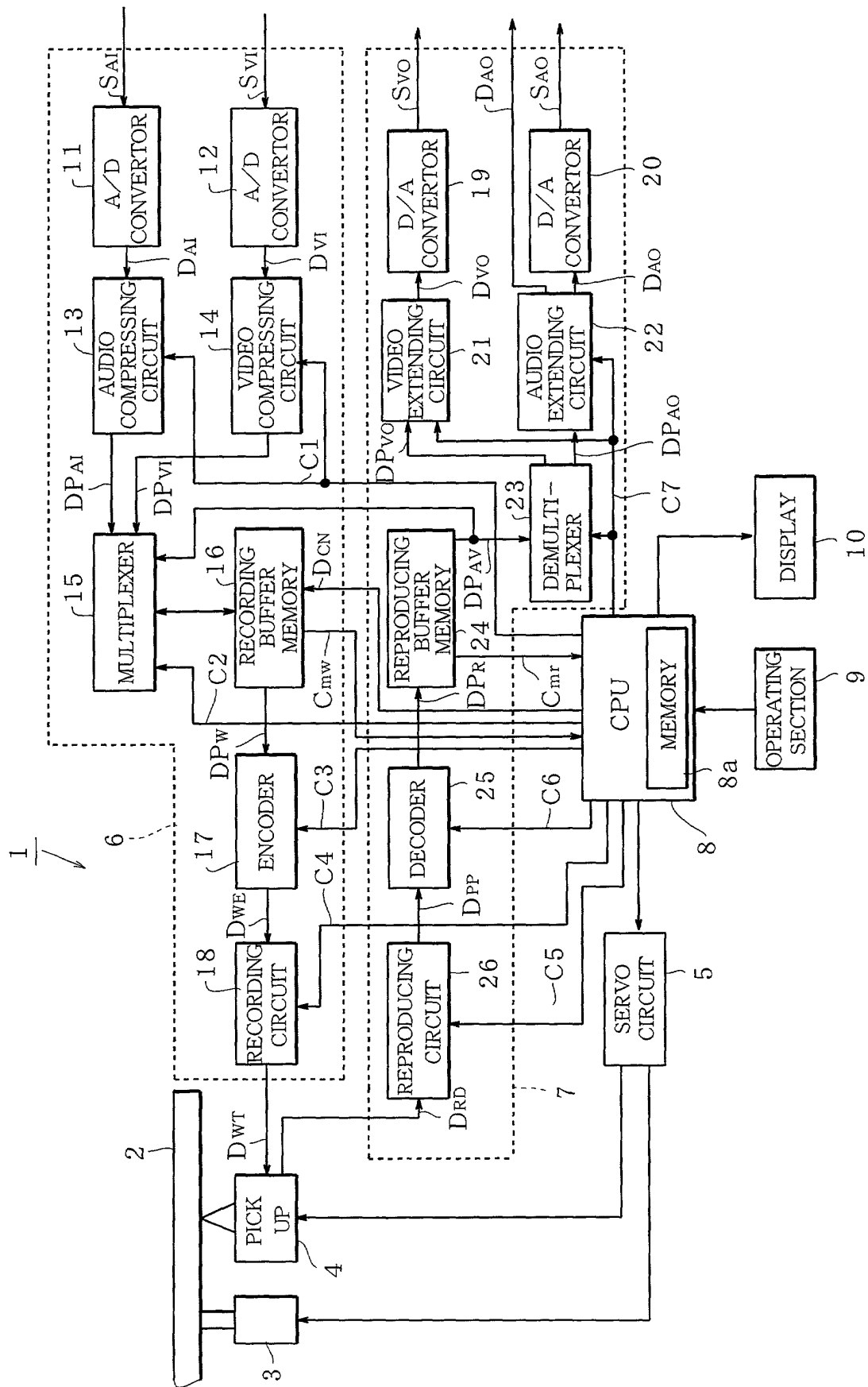


FIG.3

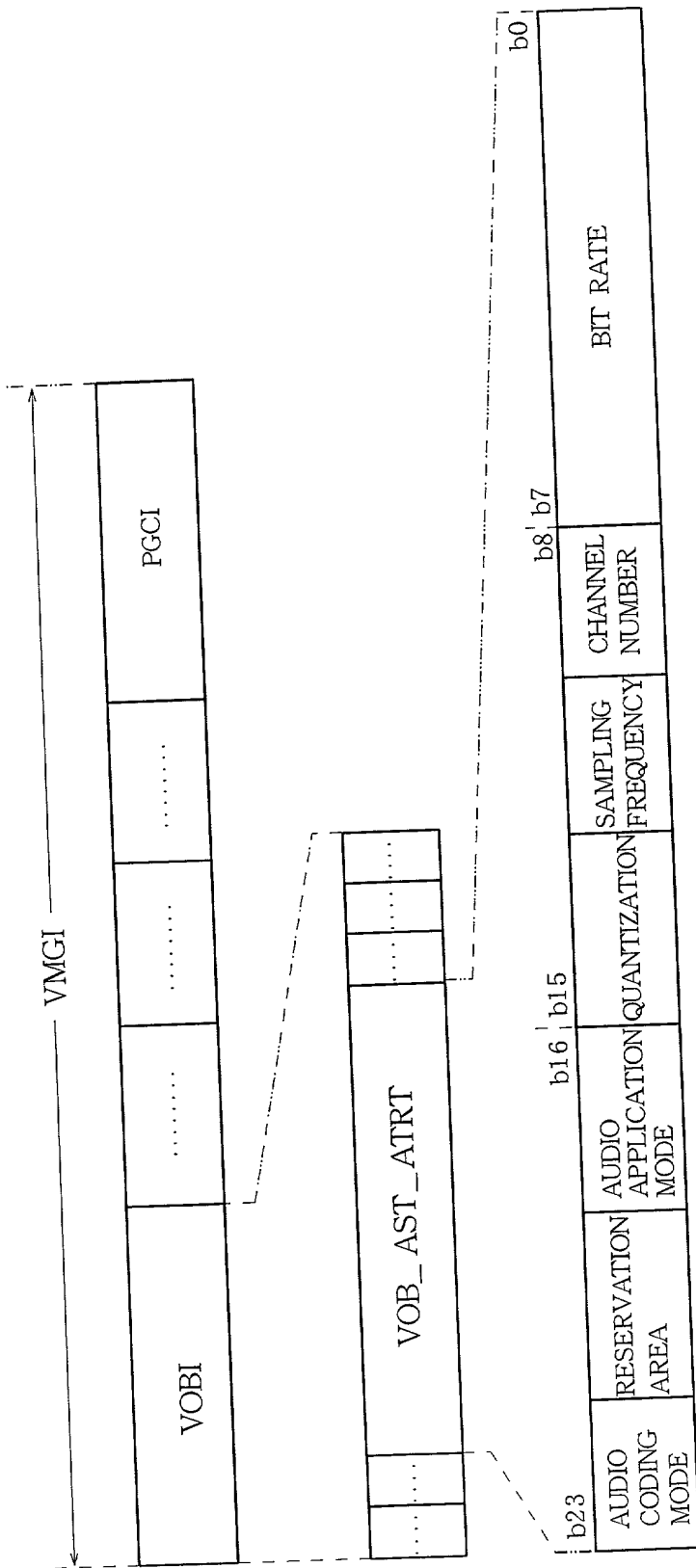


FIG.4

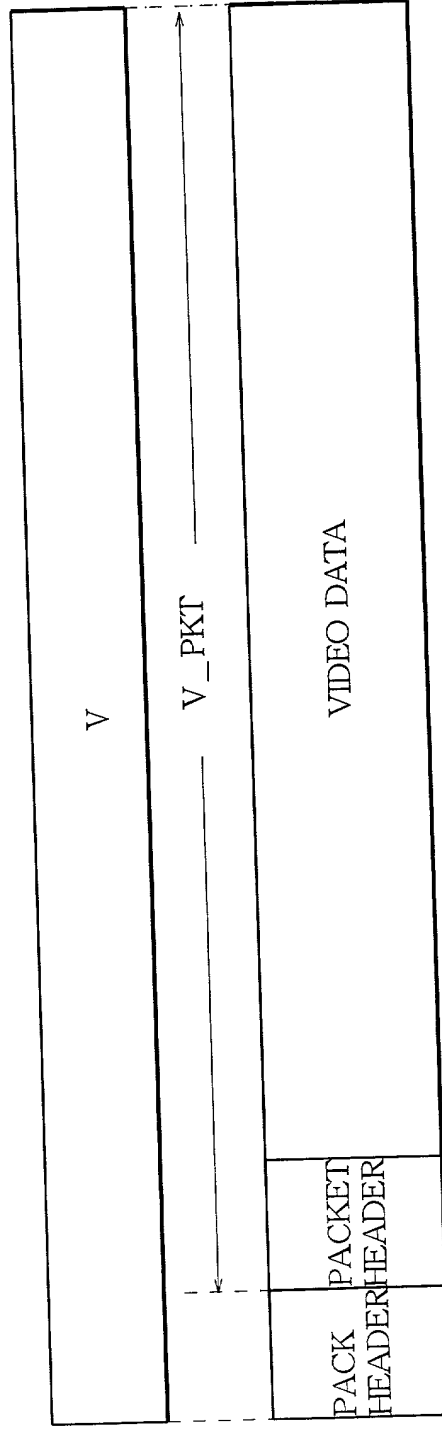


FIG.5 a

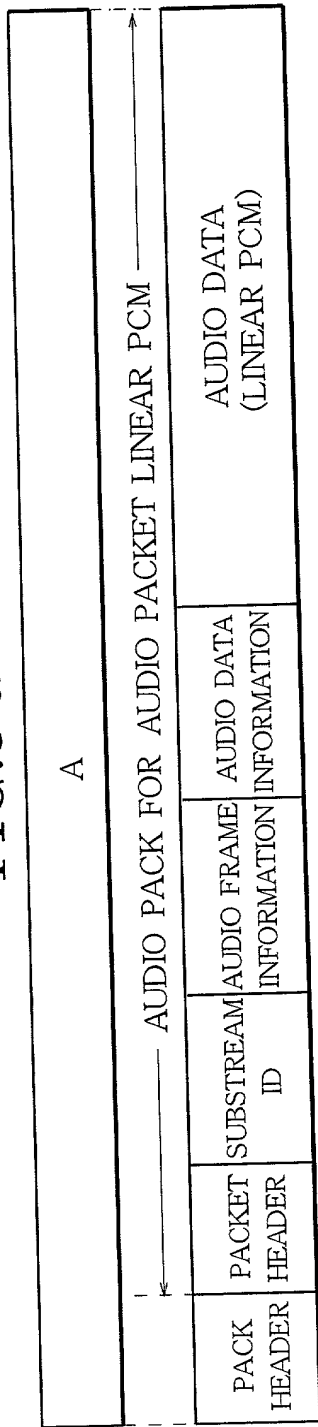


FIG.5 b

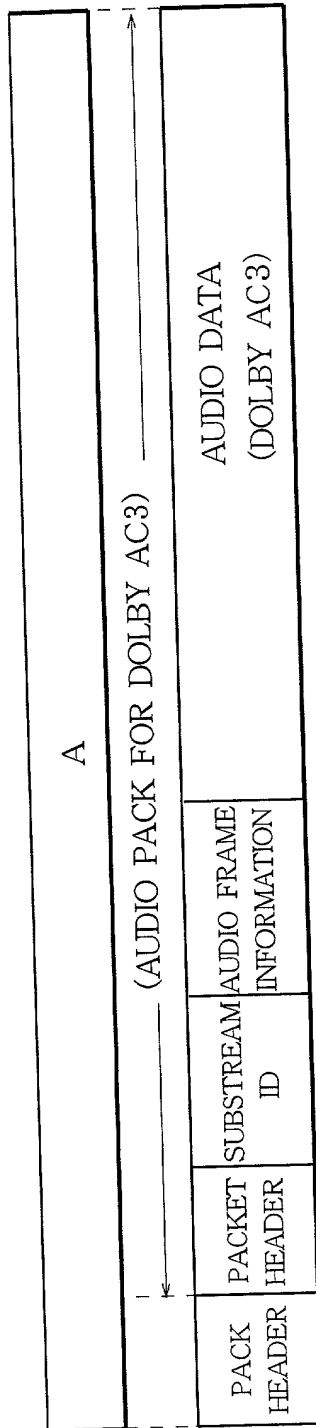


FIG.5 c

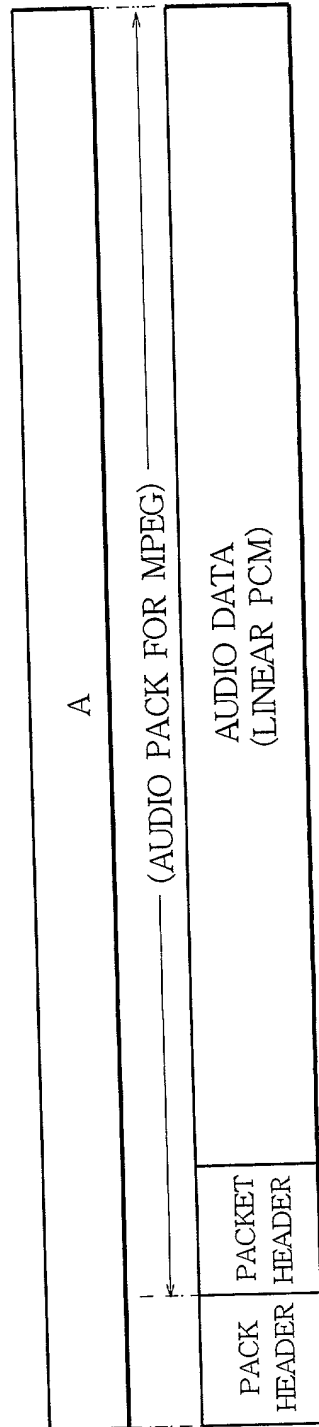


FIG.6

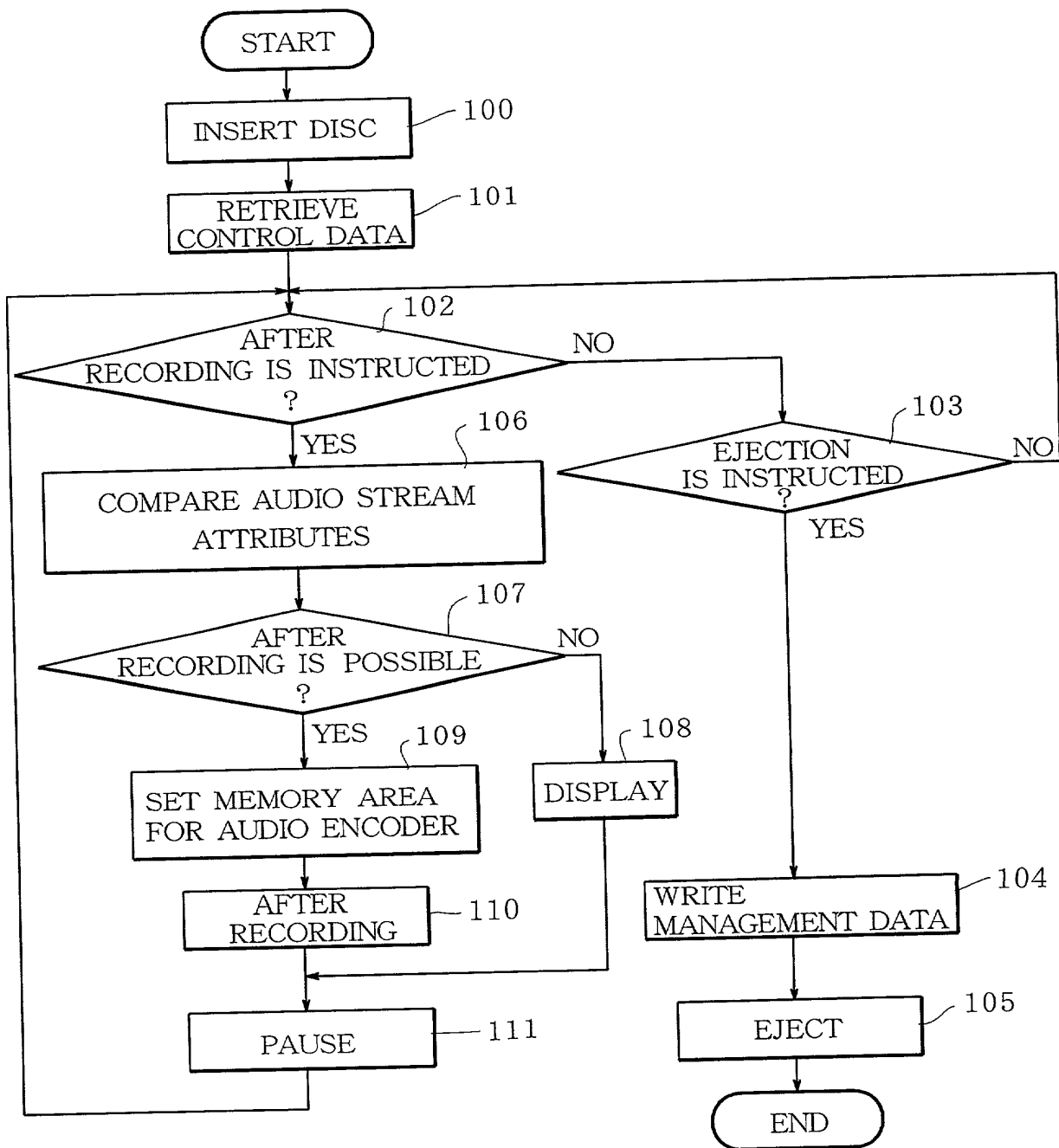
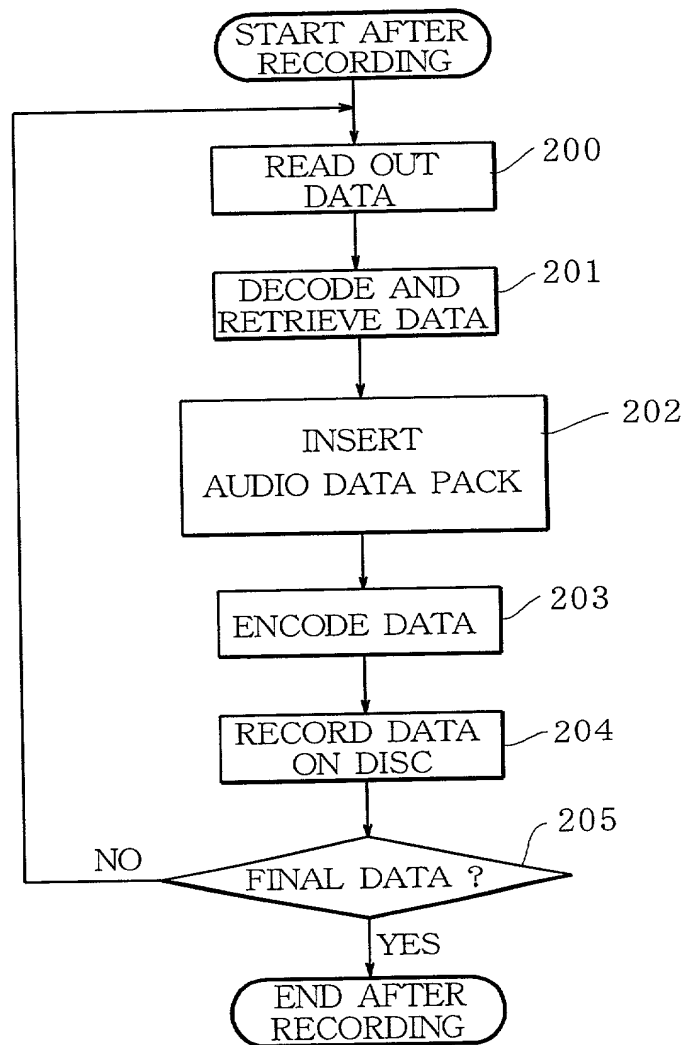


FIG.7



Declaration For U.S. Patent Application

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

(Insert Title) "RECORDING MEDIUM, AND SYSTEM AND METHOD FOR RECORDING AND REPRODUCING THE RECORDING MEDIUM"

the specification of which is attached hereto unless the following box is checked:

☐ was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate or PCT International Application having a filing date before that of the application(s) for which priority is claimed:

(List prior foreign applications. See note A on back of this page)	<u>11-16838</u>	<u>Japan</u>	<u>26/01/1999</u>	Priority Claimed
	(Number)	(Country)	(Day/Month/Year Filed)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
	<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/> Yes <input type="checkbox"/> No
	(Number)	(Country)	(Day/Month/Year Filed)	<input type="checkbox"/> Yes <input type="checkbox"/> No
	<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/> Yes <input type="checkbox"/> No
	(Number)	(Country)	(Day/Month/Year Filed)	

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

<u> </u>	<u> </u>
(Application Number)	(Filing Date)
<u> </u>	<u> </u>
(Application Number)	(Filing Date)

(See Note B on back of this page)

☐ See attached list for additional prior foreign or provisional applications.

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or §365(c) of any PCT International application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) (U.S. or PCT) in the manner provided by the first paragraph of 35, U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(List prior U.S. Applications or PCT International applications designating the U.S.)	<u> </u>	<u> </u>	<u> </u>
	(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
	<u> </u>	<u> </u>	<u> </u>
	(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(See Note C on back of this page)

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Inventor's signature Hidehiro Ishii January 17, 2000
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4-chome, Tokorozawa-shi, Saitama-ken 359-8522 Japan

Full name of fourth joint inventor, if any _____
Inventor's signature _____ Date _____
Residence _____
Citizenship _____
Post Office Address _____

Full name of fifth joint inventor, if any _____
Inventor's signature _____ Date _____
Residence _____
Citizenship _____
Post Office Address _____

Full name of sixth joint inventor, if any _____
Inventor's signature _____ Date _____
Residence _____
Citizenship _____
Post Office Address _____

Full name of seventh joint inventor, if any _____
Inventor's signature _____ Date _____
Residence _____
Citizenship _____
Post Office Address _____